(2) Small watertight cargo tank hatch covers.

(3) A Class 1 door in a watertight bulkhead within the superstructure.

(4) Remotely operated sliding watertight doors.

(5) Side scuttles of the non-opening type.

(b) *Heel angle.* (1) Except as described in paragraph (b)(2) of this section, the maximum angle of heel must not exceed 15 degrees (17 degrees if no part of the freeboard deck is immersed).

(2) The Commanding Officer, Marine Safety Center will consider on a case by case basis each vessel 492 feet (150 meters) or less in length having a final heel angle greater than 17 degrees but less than 25 degrees.

(c) *Range of stability.* Through an angle of 20 degrees beyond its position of equilibrium after flooding, a tankship must meet the following conditions:

(1) The righting arm curve must be positive.

(2) The maximum righting arm must be at least 3.95 inches (10 cm).

(3) Each submerged opening must be weathertight.

(d) *Progressive flooding.* Pipes, ducts or tunnels within the assumed extent of damage must be either—

(1) Equipped with arrangements such as stop check valves to prevent progressive flooding to other spaces with which they connect; or

(2) Assumed in the design calculations required by §172.130 to flood the spaces with which they connect.

(e) *Buoyancy of superstructure.* The buoyancy of any superstructure directly above the side damage is to be disregarded. The unflooded parts of superstructures beyond the extent of damage may be taken into consideration if they are separated from the damaged space by watertight bulkheads and no progressive flooding of these intact spaces takes place.

(f) *Metacentric height.* After flooding, the tankship's metacentric height must be at least 2 inches (50mm) when the ship is in the upright position.

(g) *Equalization arrangements.* Flooding equalization arrangements requiring mechanical operation such as valves or cross-flooding lines may not be assumed to reduce the angle of heel. Spaces joined by ducts of large cross sectional area are treated as common spaces.

(h) *Intermediate stages of flooding.* If an intermediate stage of flooding is more critical than the final stage, the tankship must be shown by design calculations to meet the requirements in this section in the intermediate stage.

[CGD 79–023, 48 FR 51040, Nov. 4, 1983, as amended by CGD 88–070, 53 FR 34537, Sept. 7, 1988]

Subpart G—Special Rules Pertaining to a Ship That Carries a Bulk Liquefied Gas Regulated Under Subchapter O of This Chapter

§ 172.155 Specific applicability.

This subpart applies to each tankship that has on board a bulk liquefied gas listed in Table 4 of part 154 of this chapter as cargo, cargo residue, or vapor.

§ 172.160 Definitions.

As used in this subpart—

(a) *Length* or *L* means the load line length (LLL).

(b) *MARVS* means the Maximum Allowable Relief Valve Setting of a cargo tank.

§ 172.165 Intact stability calculations.

(a) Design calculations must show that 2 inches (50mm) of positive metacentric height can be maintained by each tankship when it is being loaded and unloaded.

(b) For the purpose of demonstrating compliance with the requirements of paragraph (a) of this section, the effects of the addition of water ballast may be considered.

§ 172.170 Damage stability calculations.

(a) Each tankship must be shown by design calculations to meet the survival conditions in §172.195 in each condition of loading and operation assuming the damage specified in §172.175 for the hull type specified in Table 4 of part 154 of this chapter.

(b) If a cargo listed in Table 4 of part 154 of this chapter is to be carried, the vessel must be at least the ship type

specified in Table 4 of part 154 of this chapter for the cargo.

§ 172.175 Character of damage.

(a) If a type IG hull is required, design calculations must show that the vessel can survive damage at any location.

(b) If a type IIG hull is required, design calculations must show that a vessel—

(1) Longer than 492 feet (150 meters) in length can survive damage at any location; and

(2) 492 feet (150 meters) or less in length can survive damage at any location except the transverse bulkheads bounding an aft machinery space. The machinery space is calculated as a single floodable compartment.

(c) If a vessel has independent tanks type C with a MARVS of 100 psi (689 kPa) gauge or greater, is 492 feet (150 meters) or less in length, and Table 4 of part 154 of this chapter allows a type IIPG hull, design calculations must show that the vessel can survive damage at any location, except as prescribed in paragraph (e) of this section.

(d) If a type IIIG hull is required, except as specified in paragraph (e) of this section, design calculations must show that a vessel—

(1) 410 feet (125 meters) in length or longer can survive damage at any location; and

(2) Less than 410 feet (125 meters) in length can survive damage at any location, except in the main machinery space.

(e) The calculations in paragraphs (c) and (d) of this section need not assume damage to a transverse bulkhead unless it is spaced closer than the longitudinal extent of collision penetration specified in Table 172.180 from another transverse bulkhead.

(f) If a main transverse watertight bulkhead or transverse watertight bulkhead bounding a side tank or double bottom tank has a step or a recess that is longer than 10 feet (3.05 meters) located within the extent of penetration of assumed damage, the vessel must be shown by design calculations to survive damage to this bulkhead. The step formed by the after peak bulkhead and after peak tank top is not a step for the purpose of this regulation.

§ 172.180 Extent of damage.

For the purpose of § 172.170—

(a) Design calculations must include both side and bottom damage, applied separately; and

(b) Damage must consist of the penetrations having the dimensions given in Table 172.180 except that, if the most disabling penetrations would be less than the penetrations given in Table 172.180, the smaller penetration must be assumed.

TABLE 172.180—EXTENT OF DAMAGE

COLLISION PENETRATION	
Longitudinal extent	$0.495L^{2/3}$\ or 47.6 feet ($(1/3)L^{2/3}$ or 14.5m) whichever is shorter.
Transverse extent [1]	B/5 or 37.74 feet (11.5m) [2] whichever is shorter.
Vertical extent	From the baseline upward without limit.
GROUNDING PENETRATION AT THE FORWARD END BUT EXCLUDING ANY DAMAGE AFT OF A POINT 0.3L AFT OF THE FORWARD PERPENDICULAR	
Longitudinal extent	$0.495L^{2/3}$ or 47.6 feet ($(1/3)L^{2/3}$ or 14.5m) whichever is shorter.
Transverse extent	B/6 or 32.81 feet (10m) whichever is shorter.
Vertical extent from the molded line of the shell at the centerline.	B/15 or 6.6 feet (2m) whichever is shorter.
GROUNDING PENETRATION AT ANY OTHER LONGITUDINAL POSITION	
Longitudinal extent	L/10 or 16.41 feet (5m) whichever is shorter.
Transverse extent	B/6 or 16.41 feet (5m) whichever is shorter.
Vertical extent from the molded line of the shell at the centerline.	B/15 or 6.6 feet (2m) whichever is shorter.

[1] Damage applied inboard from the vessel's side at right angles to the centerline at the level of the summer load line assigned under Subchapter E of this chapter.

[2] B is measured amidships.

§ 172.185 Permeability of spaces.

(a) When doing the calculations required in § 172.170, the permeability of a floodable space other than a machinery space must be as listed in Table 172.060(b).

(b) Calculations in which a machinery space is treated as a floodable space must be based on an assumed machinery space permeability of 85%, unless the use of an assumed permeability of less than 85% is justified in detail.

(c) If a cargo tank would be penetrated under the assumed damage, the cargo tank must be assumed to lose all cargo and refill with salt water up to